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## PRIORITY DOCUMENT

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Piston-cylinder device with position sensing means.

The invention relates to a pressure medium activated piston-cylinder device including a cylinder barrel with a cylinder bore, a piston movably guided in the cylinder bore, and a position indicating device for indicating one or more piston positions in the cylinder bore, wherein the position indicating device comprises a magnetic activating element carried on the piston and a sensor unit mounted on the cylinder barrel.

According to a common technique, at least for pneumatic cylinders, indication of piston positions in the cylinder bore is accomplished by a device comprising a magnetic activating element mounted on the piston and one or more single-point sensors adjustably mounted on the cylinder barrel. A problem concerned with this well known technique is the difficulty to obtain a quick and easy re-setting of the sensors into new positions on the cylinder barrel in order to get indications of new piston positions. These sensors have to be moved individually and locked in their new positions by manual operation which is rather tricky and time consuming. Another problem concerned with this known type of position indicating technique is that the number of indicated positions is limited to a few points which is limiting to the piston action control possibilities.

In US Patent No. 6,351,117 there is described an alternative way of obtaining position indication in, inter alia, hydraulic cylinders by means of a magnetically activated magnetostrictive transducer using electric pulses for measurement. This type of position sensing device is described per se in US 3,898,555.

In a device described in US 6,351,117 the transducer is mounted concentrically in the cylinder bore and extend from

one of the cylinder end walls into the piston/piston rod, whereas the activation magnet is mounted on the piston. This is a rather awkward location of the transducer, because firstly it requires an expensive specially designed piston/piston rod and cylinder end wall, and the transducer is difficult to get to in case of maintenance and replacement. A problem arising at piston-cylinder device applications is to find a way to locate the transducer without complicating the cylinder design compared to the above related common technique.

Accordingly, the problem to be solved by the invention is to provide a piston-cylinder device with a continuously acting position indicating device of the magnetostrictive transducer type as described in the above publications while keeping the common and quite simple cylinder design as used in present type pneumatic cylinders, i.e. without including the rather complicated and expensive internal piston/piston rod location of the transducer.

Consequently, it is a main object of the invention is to provide a pressure medium activated piston-cylinder device of the commonly used pneumatic cylinder design with the magnetostrictive transducer type position indicating device which provides the favourable features of a continuous position sensing with a large number of easy to set indicating points whereby a considerably improved control of the piston action is obtained.

A further object is to provide a piston-cylinder device where cavities in the cylinder barrel are utilised for allocating the position sensing transducer as well as electronic components connected to the transducer.

According to the invention the above objects and advantages are obtained by providing a piston-cylinder device with a sensor unit in the form of a magnetostrictive type

transducer which is located on the cylinder barrel in an offset parallel disposition relative to the cylinder bore for co-operation with a magnetic activation element carried by the piston.

A preferred embodiment of the invention is described below with reference to the accompanying drawing.

On the drawing

Fig. 1 shows a longitudinal section through a piston-cylinder device according to the invention.

Fig. 2 shows a side view of the device in Fig. 1.

Fig. 3 shows a cross section of the device in Fig. 1.

The piston-cylinder device illustrated in the drawings comprises a cylinder barrel 10 with a cylinder bore 11 and two opposite end walls 12 and 13, a piston 14 movably guided in the cylinder bore 11 and a piston rod 15 connected to the piston 12 and extending out of the cylinder barrel 10 via an opening one of the end walls 12.

Moreover, the cylinder barrel 10 is provided with external connections for communication of pressure medium to and from the cylinder bore 11 as well as passages for ducting motive pressure medium to and from the ends of the cylinder bore 11 for accomplishing movement of the piston. These parts are not illustrated, because they do not form any part of the invention.

A position sensing and indicating device comprises an activating magnetic element 17 mounted on the piston 14 and an elongate sensor unit in the form of a magnetostrictive transducer 18 mounted on the cylinder barrel 10. The transducer 18 extends over a major part of the length of the cylinder barrel 10 and is connected to electronic components on a circuit board 19.

As illustrated in Fig. 2, the magnetostrictive transducer 18 is mounted in a groove 20 extending in an offset parallel disposition relative to the cylinder bore 11 and is protected from external damage, dirt etc. by a cover strip 21 preferably of a resinous material.

The groove 20 is formed with a widened cavity 24 in which is mounted the circuit board 19, and adjacent the circuit board 19 there is located a panel 25 carrying a number of LED elements 26a-d for visual indication of pre-set positions reached by the piston 14. A cable 27 extends out through the panel 25 and is intended for connection of the circuit board 19 to a remotely located programmable control unit, for instance in the form of a PC.

In operation, indications are obtained as the magnetic element 17 on the piston 14 passes pre-set indication points on the transducer 18. These indications are shown visually via the LED elements and are used for governing the supply of pressure medium to and from the cylinder bore 11, thereby controlling the operation of the piston 14. Since this type of position indicating transducer 18 makes it possible to get indications of a large number of piston positions it is possible not only to obtain stop/start functions but also retardation ramps, for instance in the vicinity of the cylinder end walls 12,13. This makes it possible to simplify the cylinder design by omitting the adjustable flow restrictions normally built-in in the cylinder end walls 13,14.

The operation order of the micro pulse operated magnetostrictive transducer 18 is well known per se is not described in detail in this specification. The lateral arrangement of the transducer 18 according to this invention is new and makes it possible to combine the extended possibilities to control and monitor the operation

of a piston-cylinder device with the simple design of the present type of pneumatic cylinders.

The position indicating points on the transducer 18 are set electronically via a remotely located computer, and the circuit board 19 and no manual re-arrangement of the transducer 18 is required. The electronics are preferably arranged to make possible an indication point setting according to the teach-in technique.

03-04-07

Claims.

1. Pressure medium activated piston-cylinder device, comprising a cylinder barrel (10) with a cylinder bore (11), a piston (14) movably guided in the cylinder bore (11), and a position indicating device arranged to indicate one or more piston positions in the cylinder bore (11), wherein the position indicating device comprises a magnetic activating element (17) mounted on the piston (14) and a sensor unit (18) mounted on the cylinder barrel (10), c h a r a c t e r i z e d in that said sensor unit comprises an elongate magnetostrictive transducer (18) which is disposed in an offset parallel disposition relative to the cylinder bore (11) and which extends over a substantial part of the length of the cylinder bore (11), and an electronic circuitry (19) connected to said transducer (18) and arranged to define one or more randomly chosen points on said transducer (18) for indication of piston positions of particular interest.
2. Actuator according to claim 1, wherein said transducer (18) is disposed in a longitudinal groove (20) in the cylinder barrel (10) extending in an offset parallel disposition relative to the cylinder bore (11).
3. Actuator according to claim 1 or 2, wherein said electronic circuitry includes a circuit board (19) mounted in a cavity (24) in the cylinder barrel (10).
4. Actuator according to anyone of claims 1-3, wherein said electronic circuitry comprises means for remote teach-in of desired piston positions.
5. Actuator according to claim 3 or 4, wherein one or more LED elements (26a-d) are mounted on the cylinder barrel (10) for indicating visually certain piston positions.

Abstract.

A pressure activated piston-cylinder device comprises a cylinder barrel (10) with a cylinder bore (11) and opposite and walls (12,13), a piston (14) with a piston rod (15) movably guided in the cylinder bore (11), and a piston position sensing and indicating device including a magnetic activating element (17) carried on the piston (14) and a magnetostrictive type position sensing transducer (18) mounted in a longitudinal groove (20) in the cylinder barrel (10) in an offset parallel disposition relative to the cylinder bore (11), wherein electronics in the form of a circuit board (19) are connected to the transducer (18) and to a remotely located programmable control unit, preferably a PC, and arranged to enable teach-in setting of the piston positions to be indicated.

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FIG 1

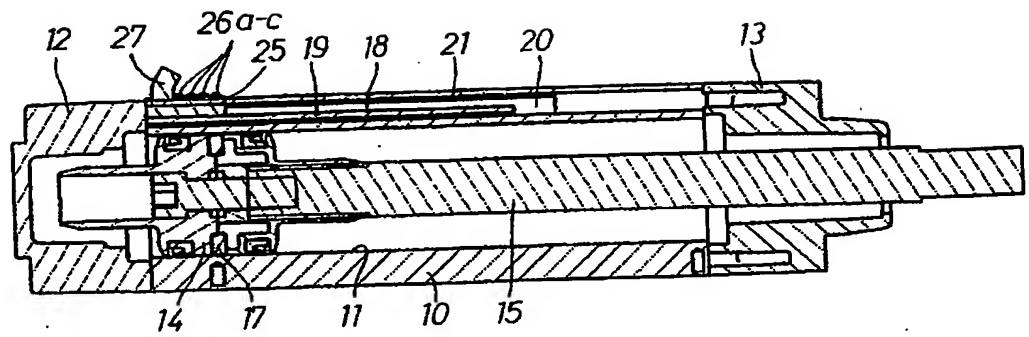


FIG 2

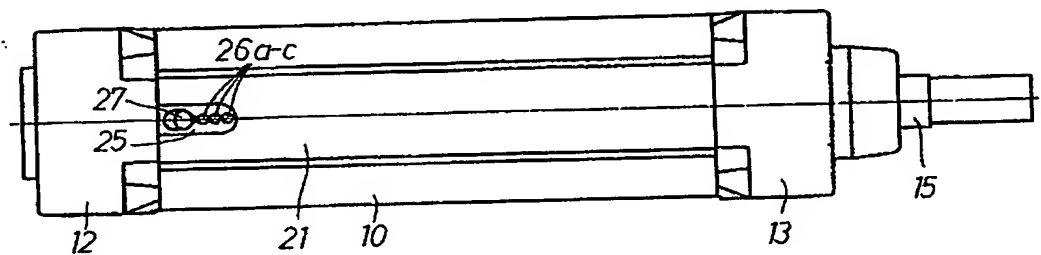


FIG 3

